

Mixed Waste Remediation Using HUMASORB-CS™ - an Adsorbent to Remove Organic and Inorganic Contaminants

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Abstract¹

The groundwater contamination at different Department of Energy (DOE) and other similar industrial sites is complex due to the presence of both volatile organic compounds (VOC) and heavy metals. In a singlestep, the state-of-the-art technologies for treatment of contaminated water systems remediate only one class of contaminants, i.e., either VOCs or heavy metals. At sites having mixed contaminants, two different processes are required to remediate a site. The two-step approach increases complexity and the cost of remediation.

The objective of this project is to develop an adsorbent, HUMASORB-CS™, to remove heavy metal and organic contaminants from groundwater and surface water streams in a single processing step. The starting material for the development of HUMASORB-CS™ is a liquid humic acid product manufactured and marketed by ARCTECH, Inc. Humic acid is a complex aromatic macromolecule with various linkages between the aromatic groups. The various functional groups in humic acid include, carboxylic, phenolic, enolic and carbonyl structures of various types. Metals are bound to the carbon skeleton of humic substances through heteroatoms such as nitrogen, oxygen or sulfur. The most common metal binding occurs via carboxylic and phenolic oxygen, but nitrogen and sulfur also have a positive effect on metal binding. The properties of HUMASORB-CS™ that are useful for mixed waste remediation include:

- high cation exchange capacity
- ability to chelate metals
- ability to adsorb organics

HUMASORB-CS™ is being evaluated for contaminant removal under simulated barrier conditions. The conditions simulate barrier installation depths of approximately 10 feet and 100

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feet. In these tests, a simulated waste stream containing a mixture of metals, organics and radionuclide surrogates is being passed through the barriers. The tests are on-going for more than 18 months and the results indicate that HUMASORB-CS™ is effective in removing contaminants (metals, organics and radionuclide surrogates) under simulated barrier conditions at different pressures in a single treatment step.

A HUMASORB-CS™ based treatment system was used recently at the Johnston Atoll facility of the Department of Defense (DOD) for treatment of Spent Decontamination Solution (SDS) to remove lead, mercury and arsenic. ARCTECH mobilized a system on-site at Johnston Atoll and successfully treated more than 25,000 gallons of SDS to meet the levels set by the Environmental Protection Agency (EPA). A follow-on study has been initiated by the U.S. Army to evaluate the use of a HUMASORB-CS™ based unit for in-line treatment of brines generated from the incinerator facility.

The remediation of contaminated streams and groundwater has been traditionally approached with at least a two-step process including some combination of activated carbon and ion-exchange process. The removal of heavy metals from contaminated water has been accomplished by techniques such as the addition of a precipitating agent, ion-exchange or reverse osmosis. These techniques require considerable capital investment and in addition would require pretreatment in some cases to remove oil and suspended solids. HUMASORB-CS™, derived from a naturally occurring material has the potential to alleviate some of these limitations by combining remediation efforts into a single step process. HUMASORB-CS™ could be used for groundwater cleanup, both in the *in-situ* mode and in a pump and treat process.

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